CSC 8980
Distributed Systems
Fall 2022

Projects #1 and #2

The following two projects are both addressing the problem of providing distributed mutual exclusion via the Maekawa algorithm. You will be working in groups of four (4).

Project #1: Using a programming language of your choice, implement an algorithm that generates the sets required for Maekawa's mutual exclusion algorithm. You must implement a simulated distributed computing environment in which nodes join and leave the distributed system. Your simulated system must be able to deal with any number of nodes, i.e., you may have to compute degenerate sets. Further, your simulation should allow for nodes to be added and/or fail. This will require the dynamic recalculation of the sets. You may assume that all nodes can be informed before a node fails or is added.

Deliverables for Project #1:
1. A short report (< 5 pages) that describes the algorithm you developed to generate the corresponding sets.
2. An implementation of the algorithm in a programming language of your choice.

For **Project #2**, you may choose any one of the two projects below (i.e., Project #2A or #2B)

Project #2A: For this project, you will implement a protocol that will balance the load on a set of n computing nodes. Consider four (4) "head nodes" that receive tasks (computing requests) from users that are distributed across the network. These head nodes are responsible for sending the tasks to one of the n compute nodes. However, it is the head nodes' responsibility to balance the load of the n compute nodes as best as possible. Computing requests can arrive at any of the four head nodes at any time, and the head nodes have to decide, based on load information from the n compute nodes, where to allocate each request. You must implement a suitable protocol and show that the load across the n compute nodes is approximately balanced.

Project #2B: For this project, you will implement Maekawa's mutual exclusion algorithm to coordinate mutual exclusive access to a single resource. Given a distributed system with n nodes, you must first use the result of Project #1 to compute the sets used to implement Maekawa's algorithm. You then develop a simulation in which individual nodes request mutual exclusive access to a shared resource.

Deliverables for Project #2:
1. A short report (< 5 pages) that describes how you simulated the interaction of nodes.
2. An implementation of the simulation in a programming language of your choice.
3. Test results demonstrating your implementation.

Your group will prepare a short (< 15 min) presentation during which you will be demonstrating your implementation of both, Project #1 and #2. The project presentation will be scheduled during the last week of the regular semester.